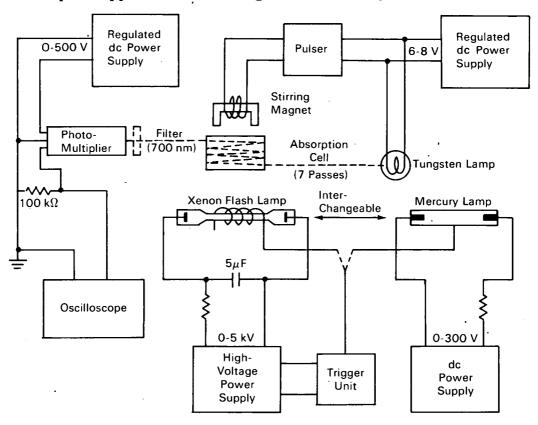


AEC-NASA TECH BRIEF



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Compact Apparatus for Photogeneration of Hydrated Electrons



A new flash-photolysis instrument specially designed to generate hydrated electrons and for study of their reactions is described in detail in the reference. With its unique, three-dimensional, multiple-reflection cell and its capacity to produce up to $10^{-7}Me_{aq}$ in a single 40- μ sec light pulse, this instrument provides adequate sensitivity for determination of aq rate constants and for use in analytical chemistry. With the instrument, less than $10^{-9}Me_{aq}$ can be detected.

Hydrated electrons are generated in a H_2 -saturated alkaline solution by a flash of ultraviolet light. The well-established reactions producing $e_{\overline{aq}}$ are

$$OH^2 + h\nu \rightarrow OH + e_{\overline{aq}}$$
 (1)

$$OH + H_2 \rightarrow H_2O + H \quad (2)$$

$$H + OH \rightarrow e \bar{q}$$
 (3)

Note that each light quantum, effective in reaction-1, eventually produces a second $e_{\bar{aq}}$ via reactions 2 and

(continued overleaf)

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3; but scavengers such as O_2 , when present even in submicromolar concentrations, profoundly affects its formation and decay. For their elimination the solutions are preirradiated with a second ultraviolet mercury lamp. After cleanup, the syringe-handling technique is used to add the scavengers at submicromolar levels. During preirradiation and after the injection of samples, the solution in the cell is mixed by a small, glass-encased, iron rod that is activated by a solenoid receiving repetitive pulses from a pulsegenerating circuit.

The apparatus shown consists of a xenon flash lamp, a mercury ultraviolet lamp, a suprasil (R) quartz irradation cell, a tungsten lamp, an optical system, red filters, a photomultiplier, and an oscilloscope.

The hydrated-electron concentration is followed by monitoring of the light-transmission of the solution at 700 nm near its optical-absorption maximum. At this wavelength its molar extinction coefficient is $1.85 \times 10^4 \ M^{-1} \ \mathrm{cm}^{-1}$. For increased sensitivity the narrow analyzing light beam from a tungsten lamp is passed through the cell seven times. Next the light passes through a red-filter combination and then into the cathode of a photomultiplier tube. The transient absorption signal is finally displayed on an oscilloscope and recorded.

Reference:

Schmidt, K.; Hart, E. J.: A Compact Apparatus for Photogeneration of Hydrated Electrons. Argonne National Laboratory, Jan. 1968.

Notes:

- 1. This information may interest researchers studying hydrated electrons.
- 2. Inquiries concerning this innovation may be directed to:

Office of Industrial Cooperation Argonne National Laboratory 9700 South Cass Avenue Argonne, Illinois 60439 Reference: B70-10036

> Source: K. Schmidt, E. Hart Chemistry Division (ARG-10487)

Patent status:

Inquiries concerning rights to commercial use of this innovation may be made to:

Mr. George H. Lee, Chief Chicago Patent Group U.S. Atomic Energy Commission Chicago Operations Office 9800 South Cass Avenue Argonne, Illinois 60439